AEROLOGICAL OBSERVATIONS

[Aerological Division, D. M. LITTLE, in charge]

By L. T. SAMUELS

Marked differences in the temperature departures for September occurred in the higher levels between Seattle and San Diego, positive values prevailing over the former station and negative values over the latter. Moderately large negative temperature departures also occurred in the lower levels at Washington, D. C. At the other stations with a sufficient period of record for the determination of approximate normals, temperature departures were relatively small. (See table 1 and footnote thereon.) Upper-air relative humidity departures, in general, were of opposite sign to those of temperature. The lowest mean relative humidities for the month occurred in the upper levels over Sunnyvale, Calif.

The upper-air resultant winds for September were, in general, as follows: At the 3,000-meter level, the directions at most stations were close to normal. The most marked exceptions occurred at Oklahoma City and Atlanta, where they were diametrically opposite to the normal. Velocities were moderately above normal at most stations east of the Mississippi River and along the Pacific coast, and below normal elsewhere.

TABLE 1.—*Mean free-air temperatures and relative humidities obtained by airplanes during September 1935*

TEMPERATURE (° C).

Stations	Altitude (meters) m. s. l.																Number of observations
	Surface		500		1,000		1,500		2,000		2,500		3,000		4,000		5,000		
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	
Barksdale Field (Shreveport), La.[1] (52 m)	19.9		22.5		19.4		16.4		14.1		11.5		9.1		3.6		−2.1		29
Billings, Mont.[2] (1088 m)	12.9						15.4		12.4		8.9		5.5		−1.1		−7.6		30
Boston, Mass.[1] (5 m)	12.4		11.6		9.1		6.5		5.3		2.9		0.5		−4.7		−10.3		14
Cheyenne, Wyo.[2] (1873 m)	9.4								12.5		12.7		9.5		2.8		−4.6		30
El Paso, Tex.[2] (1194 m)	18.3						20.0		18.0		15.0		11.7		4.7		−1.7		30
Fargo, N. Dak.[2] (274 m)	9.9		13.8		12.3		10.5		7.8		5.0		2.3		−3.7		−9.7		30
Kelly Field (San Antonio), Tex.[1] (206 m)	20.2		21.5		19.2		16.6		13.4		11.0		8.1		3.0		−3.0		29
Lakehurst, N. J.[3] (39 m)	12.1		13.7		11.0		9.6		8.1		6.6		4.5		−0.1		−5.5		19
Maxwell Field (Montgomery), Ala.[1] (52 m)	19.6		21.3		19.6		17.0		14.7		12.1		9.3		3.1		−3.8		27
Mitchel Field (Hempstead, L. I.), N. Y.[1] (29 m)	13.9		14.3		12.3		10.3		7.9		5.8		3.3		−1.6		−7.5		28
Murfreesboro, Tenn.[2] (174 m)	16.6		19.8		17.6		14.6		12.2		9.4		6.5		0.0		−6.9		30
Norfolk, Va.[3] (10 m)	20.1	−1.9	19.3	−1.5	16.8	−1.6	15.1	−0.7	13.4	+0.1	11.0	+0.3	8.5	+0.4	2.9	+0.3	−3.0	+0.2	23
Oklahoma City, Okla.[2] (391 m)	16.9		18.1		17.9		15.1		13.4		11.1		8.3		2.1		−4.4		30
Omaha, Nebr.[2] (300 m)	14.9	−0.2	17.5	+0.7	17.8	−0.6	15.6	−1.1	13.2	−1.1	10.2	−1.2	7.7	−0.7	1.7	−0.3	−4.7	0.0	30
Pearl Harbor, Territory of Hawaii[3] (6 m)																			
Pensacola, Fla.[3] (24 m)	21.9	−1.3	21.5	−0.7	18.9	−0.8	16.3	−0.9	13.6	−0.7	10.8	−0.8	7.7	−1.0	2.0	−1.0	−3.6	−1.0	30
San Diego, Calif.[3] (10 m)	17.1	−1.9	17.3	+0.1	22.0	+2.4	19.5	+0.8	16.1	−1.1	12.5	−1.9	8.5	−2.8	1.3	−3.5	−3.9	−2.8	30
Scott Field (Belleville), Ill.[1] (135 m)	13.8		20.7		18.9		15.4		13.4		10.8		8.0		1.5		−5.1		27
Seattle, Wash.[3] (25 m)	12.2	−3.2	13.3	−0.1	12.9	+1.2	11.6	+1.7	9.8	+2.0	8.0	+2.0	6.0	+2.1	1.5	+2.4	−4.5	+2.5	17
Selfridge Field (Mount Clemens), Mich.[1] (177 m.)	12.3		14.6		13.2		11.2		9.1		6.8		4.4		−0.9		−7.2		30
Spokane, Wash.[2] (596 m)	12.1				16.8		15.8		12.4		9.1		5.9		−0.4		−6.7		30
Sunnyvale, Calif.[3] (10 m)	14.5	−2.4	12.4	−2.1	18.7	+0.6	20.1	+1.8	17.4	+1.4	14.0	+1.0	10.5	+0.8	4.3	+1.4	−2.2	+1.4	20
Washington, D. C.[3] (13 m)	15.7	−4.2	16.5	−2.4	14.5	−2.7	12.5	−2.5	10.8	−2.8	8.7	−1.8	6.1	−1.9	1.1	−1.5	−4.1	−1.1	25
Wright Field (Dayton), Ohio[1] (244 m)	13.3		16.8		16.9		14.3		12.3		10.5		7.8		1.7		−5.0		27

RELATIVE HUMIDITY (PERCENT)

Barksdale Field (Shreveport), La.	84		61		67		68		62		59		55		50		52		29
Billings, Mont.	52						44		43		45		46		51		51		30
Boston, Mass.	79		70		66		68		60		56		58		51		38		14
Cheyenne, Wyo.	68								61		52		50		48		51		30
El Paso, Tex.	63						51		52		54		55		51		40		30
Fargo, N. Dak.	81		66		62		54		53		53		52		49		48		30
Kelly Field (San Antonio), Tex.	94		84		80		75		76		66		62		41		41		29
Lakehurst, N. J.	92		72		72		64		60		55		51		47		51		19
Maxwell Field (Montgomery), Ala.	89		67		67		68		59		52		49		49		45		27
Mitchel Field (Hempstead, L. I.), N. Y.	91		76		71		66		63		60		56		52		49		28
Murfreesboro, Tenn.	89		84		66		66		54		48		46		43		45		30
Norfolk, Va.	82	+3	70	−1	67	−1	54	−10	49	−13	46	−12	41	−12	38	−10	38	−8	23
Oklahoma City, Okla.	83		75		65		65		60		54		50		44		41		30
Omaha, Nebr.	83	−1	69	−4	54	−1	51	−1	49	−1	50	+2	46	0	45	+1	44	+3	30
Pearl Harbor, Territory of Hawaii.																			
Pensacola, Fla.	85	+1	78	0	76	+2	69	0	65	0	59	−2	57	0	55	+2	50	+1	30
San Diego, Calif.	90	+12	80	+1	45	−10	42	−2	43	+8	43	+10	45	+13	45	+14	32	+8	30
Scott Field (Belleville), Ill.	89		52		50		57		50		47		45		45		41		27
Seattle, Wash.	90	+13	77	+1	69	−3	59	−5	51	−7	49	−5	44	−6	37	−9	37	−9	17
Selfridge Field (Mount Clemens), Mich.	85		71		64		58		52		46		44		39		40		30
Spokane, Wash.	60				50		47		47		48		48		48		44		30
Sunnyvale, Calif.	83	+9	88	+11	53	+3	35	−1	32	+1	31	+3	31	+5	28	+5	26	+5	20
Washington, D. C.	89	+11	70	+1	67	+2	64	+2	53	−6	43	−12	40	−11	42	−7	36	−4	25
Wright Field (Dayton), Ohio	91		71		61		62		54		43		43		42		42		27

[1] Army. [2] Weather Bureau. [3] Navy.

Observations taken about 4 a. m., 75th meridian time, except along the Pacific coast and Hawaii where they are taken at dawn.

NOTE.—The departures are based on "normals" covering the following total number of observations made during the same month in previous years, including the current month: Norfolk, 116; Omaha, 150; Pensacola, 165; San Diego, 163; Seattle, 46; Sunnyvale, 62; Washington, 208.

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TABLE 2.—*Free-air resultant winds (meters per second) based on pilot-balloon observations made near 5 a. m. (E. S. T.) during September 1935*

[Wind from N=360°, E=90°, etc.]

Altitude (m) m. s. l.	Albuquerque, N. Mex. (1,554 m)		Atlanta, Ga. (309 m)		Billings, Mont. (1,088 m)		Boston, Mass. (15 m)		Cheyenne, Wyo. (1,873 m)		Chicago, Ill. (192 m)		Cincinnati, Ohio (153 m)		Detroit, Mich. (204 m)		Fargo, N. Dak. (274 m)		Houston, Tex. (21 m)		Key West, Fla. (11 m)		Medford, Oreg. (410 m)		Murfreesboro, Tenn. (180 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	5	0.4	24	1.4	278	1.6	296	1.3	278	2.5	195	0.9	63	0.7	277	1.3	191	0.5	20	2.3	99	1.6	99	0.1	56	0.2
500	-----	-----	67	2.8	-----	-----	295	4.5	-----	-----	246	4.0	258	2.3	276	3.3	196	1.9	101	3.2	103	3.7	320	0.2	139	3.0
1,000	-----	-----	98	3.8	-----	-----	304	5.3	-----	-----	264	5.1	280	5.2	278	4.9	279	3.0	125	4.1	103	3.2	250	0.9	173	2.2
1,500	-----	-----	97	3.3	238	2.3	289	5.8	-----	-----	279	6.5	285	5.5	294	6.9	288	5.1	122	3.0	119	3.1	169	0.7	239	1.6
2,000	167	1.9	98	2.6	279	2.1	287	9.0	273	5.1	284	5.8	289	6.2	289	8.2	293	7.7	102	1.7	121	2.3	138	1.2	261	1.1
2,500	206	1.1	90	2.3	279	4.0	290	11.6	281	6.1	275	7.2	308	4.8	283	9.6	272	7.0	171	0.5	120	2.2	231	2.2	260	0.5
3,000	242	1.4	92	1.6	274	5.4	289	14.1	284	4.8	279	8.6	323	6.5	278	10.9	285	10.2	217	1.1	159	1.4	239	3.8	235	1.4
4,000	301	1.3	70	0.8	270	9.6	280	14.6	280	6.0	286	12.6	-----	-----	286	13.5	-----	-----	249	0.8	211	1.6	248	4.4	25	1.0
5,000	229	2.9	244	3.4	284	10.4	-----	-----	289	6.7	-----	-----	-----	-----	293	14.7	-----	-----	347	1.0	-----	-----	344	2.0	-----	-----

Altitude (m) m. s. l.	Newark, N. J. (14 m)		Oakland, Calif. (8 m)		Oklahoma City, Okla. (402 m)		Omaha, Nebr. (306 m)		Pearl Harbor, Territory of Hawaii [1] (68 m)		Pensacola, Fla.[1] (24 m)		St. Louis, Mo. (170 m)		Salt Lake City, Utah (1,294 m)		San Diego, Calif. (15 m)		Sault Ste. Marie, Mich. (198 m)		Seattle, Wash. (14 m)		Spokane, Wash. (603 m)		Washington, D. C. (10 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	344	1.6	12	1.1	189	1.4	158	1.7	55	2.1	43	3.8	220	1.1	150	3.4	15	2.6	41	0.8	150	0.5	78	1.5	278	0.3
500	330	3.3	219	1.1	179	3.8	204	5.3	81	2.6	81	4.4	215	5.7	-----	-----	345	2.6	290	1.3	22	0.4	-----	-----	276	2.2
1,000	292	5.1	336	1.9	188	5.5	239	9.4	85	4.8	89	3.5	241	4.8	-----	-----	340	2.0	288	4.8	302	0.7	230	1.6	293	3.6
1,500	296	6.9	357	2.0	186	3.9	248	8.4	95	3.6	96	2.8	265	5.1	154	4.2	249	0.2	296	6.9	233	1.2	248	2.5	299	5.8
2,000	286	7.6	195	2.0	183	2.8	259	5.8	96	2.3	69	3.9	267	5.0	191	2.4	188	1.8	295	7.6	239	1.5	248	2.9	298	7.8
2,500	-----	-----	183	3.5	165	2.3	287	5.6	227	2.6	61	4.4	271	4.8	244	1.9	155	3.8	302	9.6	266	3.4	260	5.0	292	7.6
3,000	-----	-----	-----	-----	118	1.5	287	5.6	-----	-----	60	2.6	260	4.7	270	2.6	155	4.7	303	12.0	283	3.5	263	6.6	288	7.6
4,000	-----	-----	-----	-----	35	1.8	286	5.4	-----	-----	307	2.0	249	4.7	277	4.2	149	2.8	-----	-----	270	7.5	271	6.3	282	8.3
5,000	-----	-----	-----	-----	349	4.1	303	7.3	-----	-----	-----	-----	-----	-----	270	4.7	63	0.8	-----	-----	266	7.4	317	6.8	-----	-----

[1] Navy stations.

RIVERS AND FLOODS

[River and Flood Division, MONTROSE W. HAYES, in charge]

By RICHMOND T. ZOCH

The most important flood in the United States during September was the one in the James River in Virginia. This river reached higher stages at Columbia and Richmond, Va., than had been reached at these gage stations since the great flood of November 1877.

There were heavy rains over the James River basin early in the month. The total rainfall for the 5th and 6th averaged 6.5 inches for the entire basin, but the rain was considerably heavier east of the Blue Ridge; in fact the river did not reach flood stage at or above Lynchburg. It is quite unusual for the river to reach such high stages at Columbia and Richmond, and yet remain below flood in its upper reaches.

Portions of Richmond are flooded when the river reaches a stage of 8 feet. Until 1927 the main lower business section invariably suffered heavy losses, but in that year a dike was constructed which protects this section of the city up to stages of 21 feet. As a stage higher than this was forecast, the city had sandbags placed on the dikes and took numerous other precautions, and as a result of these emergency measures the lower business section was not flooded, although the river reached a stage of 23.65 feet. The crest stage forecast was 24 feet. However, the gas plant was flooded, and the city was without gas for several days.

There were unusually heavy rains in the Rio Grande Valley in the vicinity of Las Cruces, N. Mex., on the night of August 29–30. The floods caused by them did not subside until early in September. The damage caused by these floods, which extended from Elephant Butte, N. Mex., to El Paso, Tex., exceeded $1,000,000. The Weather Bureau has no river gages in this reach of the Rio Grande. The floods in the lower Rio Grande were not serious.

Rains on September 4 to 6 were the heaviest of record over most of southern Delaware and the Eastern shore of Maryland; and they caused floods in all of the streams of that region, with extensive damage.